Money and Production in the Developing Economies:
An Analytical Survey of the Issues

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I. Introduction

The role of money in production remains an unsettled issue in monetary economics. In neoclassical theory, the determination of the level of real output was not tied to the monetary sector. The availability of real resources, and the economy's utilization of these resources to produce goods, were independent of the amount of real money balances in the economy.

Studies of the process of economic development suggest, on the other hand, that money can affect the production of goods. A number of channels have been proposed through which real money balances can influence the availability of real productive inputs, and in particular, capital. This research stresses the role of money in the decision to save and the allocation of savings among possible investments. The expansion of the monetary sector generally allows an economy to accelerate the rate of capital accumulation and to utilize its resources in a more efficient manner.

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This paper was prepared while the author was an intern in the Central Banking Department of the International Monetary Fund. I would like to thank the members of the Research and Central Banking Departments, Professor Millard Long of Boston University, and most especially Deena R. Khatkhate and Warren L. Coats, Jr. for their comments, suggestions and support. Responsibility for all opinions and errors, however, rests solely with the author.

A different analysis linking money and real output has arisen out of growth theory. Some monetary growth models, in a reaction to earlier work which ignored the productive function of money, directly ascribe a productive role to money, and introduce money into production functions as an independent variable. The parameters of these functions have been empirically estimated, but this practice has not been universally accepted. Consequently, questions regarding the precise nature of money's productive service remain.

This paper examines the different mechanisms through which money can affect an economy's output of goods and services, and the implications of these theories for the controversy over the inclusion of money in empirical production functions. In particular, the appropriateness of this procedure for the developing economies is examined. The next section surveys the theoretical and empirical literature on money and production functions. The following section examines the effect of money upon the formation of an economy's capital stock, through its impact upon savings and investment; the impact of the monetary sector upon resource utilization is then summarized. This is followed by an evaluation of the use of money as a direct input, and an alternative methodology for expressing money's role in production is presented. The paper then deals with the implications of this research for monetary policy, and concludes with a summary.

Money, for the purpose of this paper, is defined as the total amount of interest and non-interest paying liabilities of the banking system held by the public.[1] Real money balances are measured by deflating the nominal stock of money by the appropriate price index. Moreover, it is assumed that the monetary authority can affect the demand for real money balances through its interest rate policies, as well as other government actions.

II. Money and Production Functions

Production theory has been adapted to focus on the role of money in the determination of aggregate supply. Real money balances have been placed as an independent variable in aggregate

1 We do not deal with the various definitions of money applicable in the developing economies, nor with how the use of monetary assets differs among countries.

production functions, and these functions estimated with U.S. data. This practice has provoked criticism and debate over its validity and the interpretation of the estimated results. This section summarizes the research that has been done in this area, and the discussion over its merits.

1. Theoretical

The inclusion of money in production functions was a response to Tobin's (1965) seminal work on money and growth. Tobin introduced money into the neoclassical growth model as a substitute asset to capital in wealth portfolios. If the return on real money balances falls, then an adjustment of asset holdings will take place. A larger proportion of real output would be devoted to the production of capital goods rather than consumer goods, as the decrease in real balances reduces consumption expenditures. Consequently, a monetary policy devoted to price stability would lower the prevailing capital/labor ratio, since the drop in inflation would prompt a rise in the proportion of wealth held as money and discourage construction of new capital goods.

Tobin's model has produced the paradoxical result that a monetized economy is worse off than a barter economy. However, this implication is quite sensitive to the model's assumptions regarding the role of money in an economy. In particular, Tobin not only assumes that the resources saved in the form of real cash balances are not invested (so that increases in real balances do not reflect or lead to increases in capital), but that money itself contributes nothing to output. In order to counter this latter assumption, some economists postulate a direct productive role for money, and add real balances to production functions as an independent variable. In these models, the ultimate effect of inflation upon output depends on whether the output effect of the increase in capital resulting from reduced real balances is offset by the output-depressing effect of the lower real balances.

While the inclusion of real money balances in production functions can be traced back to Bailey (1962), it has received renewed attention when Levhari and Patinkin (1968) and Johnson (1969) included money balances as a productive input in their works on money and growth. Levhari and Patinkin compared a barter and a monetized economy to illustrate money's productive service. In the barter economy, real factors must be used in the distribution of

goods. The search for another resident, willing and able to exchange a desired bundle of goods, consumes resources. Money, on the other hand, obviates the need to establish the "double coincidences" required for a successful barter transfer, and allows real resources to be concentrated in the output of goods. While this reallocative process may affect all productive factors, it presumably will have its greatest impact on labor, since this is the factor used most intensively in the search procedure.

Johnson (1969) has emphasized the use of money to replace real working capital in inventory stocks as money's productive service. Money, which permits lower holdings of physical assets, allows more capital to be used directly in the production of final goods. Nadiri (1969), Perlman (1971) and Smith (1979-80) also deal with this aspect of money. Moreover, a firm's decision to hold money balances could be cited as an indication, via revealed preference, of the existence of a productive role of money.

The inclusion of a monetary variable in a production function has not gone unchallenged. Moroney (1972), Pierson (1972), Fischer (1974) and Davidson (1979-80) have argued against the practice (although Fischer has accepted the procedure in some instances as a pedagogical device). One of the primary counterargument is that a production function expresses a technological relationship between physical resources, which is based upon engineering activities invariant to financial variables. The possibility of an empirically significant relationship between output and money balances is not excluded; indeed, the use of money as a medium of exchange in factor and goods markets almost guarantees such a relationship. However, the resulting positive correlation does not necessarily imply a causative role for money in the production of goods.

Other objections, such as the appropriateness of money balances deflated by a price index as a measurement of the resources released for production, are raised by these authors. Their criticisms are not intended to deny a role to money in the theory of the production of goods. Rather, they contest the methodology of using a production function with money as a variable to express this relationship. Fischer and Moroney, for example, both urge more explicit modeling of the effect of real money growth on output via technological progress.

2. Empirical

The theoretical research on money and production prompted specification of production functions which included money, and empirical estimation of these functions. This statistical work has been limited in scope, however. The restricted use of this approach may reflect the theoretical controversy, as well as data limitations.

The pioneering work in this area has been done by Sinai and Stokes (1972). They have estimated Cobb-Douglas production functions with and without different measurements of money and a time trend to measure neutral technical progress. The data consisted of indexes of U.S. gross private domestic product, capital and labor from 1929 to 1967, adjusted for quality changes and utilization rates. The production function takes the form:

$$y = Ae^{\lambda T}L^{\alpha}K^{\beta}m^{\gamma}u \qquad (1)$$

where

y = output
L = labor
K = capital
m = real money balances
T = time
A = efficiency parameter
λ = rate of neutral technological change
α = elasticity of output with respect to labor
β = elasticity of output with respect to capital
γ = elasticity of output with respect to real money balances
u = disturbance term

Their results yielded a statistically significant coefficient on the monetary variable, at the expense of the time trend. The authors concluded that money was a better indicator of progress than a trend variable. The output elasticity with respect to real balances was reported as .127 for M1 and .122 for M2. Moreover, the value of the estimated coefficient of labor fell when real money balances were included as a separate variable. The authors interpreted this result as confirmation of the hypothesis, implicit in Levhari and Patinkin's (1968) work, of the labor-saving role of money, and deduced a "complementarity relationship" between money and labor.

Sinai and Stokes' work provoked much criticism. The econometric methodology, which included an estimation procedure to correct for the presence of autocorrelation, was disputed by Prais (1975a, 1975b), Khan and Kouri (1975), and Boyes and Kavanaugh (1979). The economic interpretation of the results was contested by Niccoli (1975) and Ben-Zion and Ruttan (1975). Niccoli suggested that the monetary variable was a proxy for investment expenditures. Ben-Zion and Ruttan advanced a theory of induced innovation, in which money indirectly stimulated technical progress through its effect on aggregate demand.

Sinai and Stokes (1975, 1977) defended their estimation practices, and their interpretation of the results. They argued that Niccoli had not explained why investment was more appropriate for a production function than money when a measurement of the capital stock is already included. Ben-Zion and Ruttan's theory of induced innovation, they pointed out, provided a tenuous connection between money and output in place of the direct impact exerted by money in a production function.

Sinai and Stokes, however, did endorse a suggestion by Khan and Kouri that a simultaneous equations model be used in future work. Short (1979) estimated such a model by incorporating factor demand equations into a production model. She also included translog production functions, as well as the Cobb-Douglas specification, and used a two-stage least squares procedure to eliminate simultaneity bias. Her work, tested with U.S. data from the same period, confirmed Sinai and Stokes' overall results regarding the statistical significance of money in production. The elasticity of output with respect to real money balances, using the Cobb-Douglas specification, was .025 for M1 and .027 for M2; the translog specification provided elasticities of .040 and .049, respectively. Both sets of results are dramatically lower than Sinai and Stokes' results. The neutral time trend estimated by Short was also significant.

III. Capital Formation

The impact of money balances upon output has also been examined in the context of the developing countries, where the relative scarcity of capital is seen as the principal impediment to growth. Expansion of the monetary sector in real terms can in-

crease the amount of capital goods, as it is a component of private savings; hence, its increase is likely to lead to an increase in the level of private savings and investment. Money's productive role in this case is an indirect one, reflected in the size of the capital stock, as opposed to the direct impact implied by the inclusion of a monetary variable in a production function.

1. Savings Mobilization

The act of savings frees resources from consumption expenditures for the production of new capital goods. Due to the insignificance of corporate savings in developing countries, the mobilization of noncorporate, particularly household, savings is crucial to private sector growth. Savings performance in these economies, however, has lagged in the last decade.[2] Although part of this decline may be due to external shocks, domestic factors are primarily responsible for changes in the savings rate. Imperfect capital markets and interest rate ceilings have often suppressed savings, and led to a gap between desired investment and savings.

Monetary policy can be a major instrument in increasing the availability of resources for investment financing. The existence of a monetary asset may improve the savings rate by providing an asset with desirable characteristics, e.g., a positive real rate of return, liquidity, and safety, which are not available in alternative forms of savings. These characteristics are particularly valued when savings have been held in commodities, such as precious metals or perishable goods, or used to finance self-owned projects which yield low rates of return. A stable monetary system enlarges the scope of intertemporal dicisions, and makes the act of savings more attractive.

The decisioins of households to increase their savings will lead to capital deepening, if the savings are lent to entrepreneurial units for investment expenditures. Even if accompanied by a rise in the interest rate which lowers desired investment, the increase in savings raises the availability of resources and the realized level of investment. As more capital goods are constructed, the economy's productive capacity will rise.

The significance of the financial system for the savings rate has

2 See Bhatt and Meerman (1978), p. 46.

usually been acknowledged in development economics,[3] although not always cited in traditional macroeconomic studies. Hooley (1962, 1963) emphasized the importance of the composition of savings in the experience of the Philippines, and estimated a positive relationship between the household savings rate and the ratio of financial to tangible assets. U Tun Wai's (1972) extensive survey of savings in developing nations demonstrated that the creation of debt instruments tailored to the needs of savers does have a favorable impact on the determination of savings. The monetary coefficient in savings functions has been found to be highest in developing nations with extensive banking systems, such as South Korea and Taiwan.

The mere existence of a financial structure cannot independently ensure a rise in savings in the obsence of helpful government policies which encourage the use of money balances. Jonas and Nasim (1976) emphasized the role of interest rates in their study of savings experience in several developing countries. While bank deposits yield an implicit convenience return, they must also pay a positive rate of return if households are to maintain savings in this form. The importance of a positive interest rate has been demonstrated in studies by Abe, Fry, Min, Vongvipanond and Yu (1977) and Fry (1978), who used pooled time series data drawn mainly from Asian countries.[4]

Studies which ignore the role of money in savings formation are likely to arrive at misleading conclusions, and possibly prescribe policies which only hinder the growth of savings. On the other hand, the importance of monetary factors in this process may prompt banking authorities to encourage the introduction of a wide array of financial assets. It is unlikely, however, that financial innovation can be forced at an accelerated pace. The history of financial institutions, as shown by Cameron (1967, 1972), demonstrates that their growth is an evolutionary process, arising from country-specific factors.

2. *International Capital Flows*

3 Mikesell and Zinser's (1973) survey of the research on savings in developing countries, however, contains only a brief review of the relationship between interest rates and savings, and no explicit treatment of the monetary sector.

4 For a summary of the evidence on the interest rate elasticity of savings, see Coats and Khatkhate (1979), p. 1892.

A particular form of savings mobilization, with implications for the balance of payments, is the inflow of savings arising from the portfolio mix of domestic and foreign assets. A decrease in the purchase of foreign financial assets by domestic savers, and an increased sale of domestic instruments to foreign savers, increases the net flow of savings into the economy. Unless completely offset by a fall in domestic savings, the net inflow of savings will permit the financing of aditional investment expenditures.

Assets denominated in a foreign currency may serve as alternative stores of value to domestic assets during periods of inflation, thus drawing savings out of an economy. They will appear particularly attractive when limits have been set on domestic interest rates. Capital controls are usually imposed during such periods, but are not always successful. Policies to encourage growth by providing investment financing at low interest rates will paradoxically produce the opposite result if even unchanged domestic savings are diverted to foreign assets.

Domestic monetary policies which make domestic financial assets relatively more attractive play an important role in raising the net inflow of savings. Domestic assets possess some degree of superior liquidity over foreign assets, even in integrated capital markets. Also, the transactions costs of maintaining a portfolio of international assets may be significant for small domestic savers in developing countries. Interest rate parity, therefore, is not always maintained between developing and developed countries. Consequently, monetary policy has some leeway in reducing the outflow of domestic savings.

The reduction in capital outflow is accompanied by a rise in the gross inflow of financial capital. The size of this inflow is jointly determined by the response of domestic borrowers and foreign investors to policies which encourage real monetary growth. High domestic lending rates cause domestic firms to turn to foreign financial intermediaries for funds. The resulting flow of capital, as shown by Mathieson (1979), may even be of such magnitude that it could pose problems for monetary control; the experience of South Korea is usually cited as an example of destabilizing private capital flows.[5]

5 Galbis (1979a), however, has pointed out that public sector borrowing accounts for much of the foreign capital flow to developing countries, and is more likely to take place during periods of financial repression than liberalization.

A rise in domestic interest rates does not necessarily signal a significant movement to foreign sources of financing. For one thing, the increase in domestic savings accompanying higher interest rates raises the availability of domestic funds. For another, the higher domestic interest rate may still lie below the cost, which includes a risk premium and transaction fees, that a private borrower from a developing nation may have to pay in international capital markets.

Nevertheless, whether domestic firms actively pursue foreign funds or not, foreign financial investment will respond to a rise in the domestic rate of return as foreign savers increase their holdings of domestic assets. Foreign direct investment may also increase if a more stable financial environment is established. Goldsmith (1964), for example, has argued that "the existence of a financial superstructure, and here particularly the operation of financial institutions, tends to increase the relative importance of foreign investment in both lending and borrowing countries."[6] Therefore, some inflow of foreign savings will be recorded. This inflow need not destabilize the government's monetary policy, if the proper countermeasures are taken. While the domestic interest rate should be set at a positive level, it need not be pegged at a level sharply divergent from real world rates. A combination of exchange rate depreciation and capital controls can diminish the effects upon the money supply of the higher interest rates, while import liberalization can offset the monetary impact.

A similar result regarding the impact of domestic monetary policy upon the balance of payments can be derived from the monetarist approach to the balance of payments. In this analysis, a country's overall reserve position under fixed exchange rates is determined by the relationship between domestic money demand and supply. If the nominal supply of money exceeds the demand for real money balances, a deficit will result as domestic residents exchange money for foreign real and financial assets. Conversely, if money demand exceeds supply, residents will acquire foreign currencies, which they exchange at their central bank for domestic money, and a balance of payments surplus is recorded. It has been further suggested that the capital account is the principal vehicle of the adjustment process; if this adjustment mechanism also functions in the developing counties, a capital inflow will be

6 Goldsmith (1964), p. 399.

recorded in response to a policy which stimulates the demand for real money balances.

The expansion of the monetary sector in real terms, therefore, can affect the net flow of savings into an economy. Whether this new source of savings provides additional investment financing, or displaces domestic savings, has been a subject of some debate. If investment expenditures are fixed, as proposed by Weisskopf (1972), then foreign savings are a substitute for domestic savings in financing this investment. Foreign capital inflows allow domestic savings to be transferred to current consumption expenditures.

It is doubtful, however, that investment expenditures in developing economies are unresponsive to the availability of additional savings. As explained in Section III.1, desired investment usually exceeds savings in these countries. Government policies in developing countries to encourage capital inflows indicate that the authorities regard foreign savings as a complement, rather than a substitute, to domestic savings. Papanek (1973) has argued that any recorded negative correlation between domestic savings and foreign investment is due to other factors, such as time lags or statistical irregularities. However, the stance of domestic monetary policy must reflect the balance of payments consequences of the relative advantages of domestic versus foreign assets, and should not encourage the inflow of more foreign savings than can be efficiently absorbed.

3. Conduit Effect

In the preceding sections, money affected investment indirectly by raising the amount of savings available for investment expenditures. A different mechanism--named the "conduit" effect--has been proposed by MacKinnon (1973), and examined by several authors. In this analysis, expansion of real money balances has a direct impact on the level of investment spending.

McKinnon's model is predicated on several particular assumptions. All investment is self-financed, and therefore any intermediary role for money is neglected. Expenditures on new capital goods are characterized by indivisibilities and must be made in lump-sum amounts. The financing of investment is accomplished by building up money balances to the requisite level, or through the sale of inventories. An increase in the return on

money lowers the cost of investment, and leads to larger money holdings as investors increase their savings in preparation for larger investment expenditures. The demand for money includes the average return to capital as a positive argument, in contrast to the usual neoclassical assumption of a negative relationship; the investment/income ratio treats the real return on monetary assets in a similar fashion.

While McKinnon's work did draw attention to money's productive role, his assumption of the use of money for self-financed investment has been criticized as too restrictive. One of money's most important functions, as mentioned previously, is that it allows the transfer of command over resources among residents. The process of intermediation allows the financing of projects, for which investors could (or would) not pay with their own savings (this role is elaborated on in the next section). These investment expenditures may indeed be characterized by indivisibilities; if so, the importance of an intermediary asset is reinforced.

Due to data limitations, empirical tests of McKinnon's model have been limited. Generally, the work which has been completed has not supported McKinnon's proposed relationships. Galbis (1979b) used the investment/income ratio in money demand functions for 19 Latin American countries, and obtained significant results in only four cases. Fry (1978b) used data from Asian nations to estimate money demand relationships, using savings as a proxy for investment. The estimated coefficient did not have the expected sign. Fry (1978a) additionally pointed out that real factors may limit the possible response of investment expenditures to financial policies.

Fry (1980) has also presented evidence on investment functioins using data drawn from 61 developing countries, and found the ratio of domestic credit to GNP, as well as the change in this ratio, to be significant. Yoo (1977) found a monetary variable important in the formation of investment, and much higher in developing countries than developed. However, these results, which could be interpreted as evidence in support of McKinnon's hypothesis, can also be explained as the result of the use of monetary assets to finance investment in the developing nations. While money undoubtedly has a role in investment expenditures, this mechanism is more likely to operate through savings than via a direct link with investment.

IV. Capital Utilization

In the literature surveyed in the preceding section, the growth of real money balances induced a rise in the amount of capital goods available for the production of goods. Money can also affect aggregate supply independently of its impact on the size of the capital stock. A rise in the use of money balances brings about a reallocation of savings to more productive investments, located through the intermediation of financial institutions. The resulting increase in the quality of the capital stock raises the contribution of capital to aggregate supply and the growth rate of the economy. The effect of money, the most important financial asset in developing countries, on output is indirect in this analysis, as it is exercised through the utilization of capital.

Capital formation, in an economy with a fully developed financial system, can be financed in three ways: self-financing by investors who use their accumulated savings; direct finance, in which savers transfer their resources directly to an investing unit in exchange for its financial liabilities; and indirect finance, conducted by financial intermediaries. All these methods are used to channel savings to investment projects. Savers can choose among the different forms of finance that investment which offers the most attractve return. The resulting allocation of resources will result in an efficient capital stock for the economy, since a given amount of savings is used to finance the most productive investment projects.

In the developing countries, however, the choice to savers of alternative investments may be sharply limited. These economies do not generally possess financial markets which gather information for savers on the availability of investments. As a result, savers may simply not be aware of more profitable opportunities. Even when they are cognizant of alternatives which offer higher rates of return, households may not take advantage of them if the assets do not have the characteristics desired by savers. Investing units do not always want to issue securities in the small denominations attractive to savers, or incur the expense of marketing them. Proposed expenditures can also contain elements of risk, which individual savers do not wish to bear.

Self-financed investments, consequently, account for a significant proportion of savings allocation in developing economies, since these are the most accessible and familiar outlets for savings.

This form of capital formation can take the form of working capital, such as tools, seeds and farm animals, or inventories of goods. Savers recycle the return on their investment, turning their profits back into their own enterprises. The direct financing which does take place is often done on an informal basis through personal contacts, e.g., advances from landlords to tenants.

While these forms of investment can provide a real rate of return to savers, they may not yield as high a return as other investments which require organized external financing. Because of the lack of financial markets which allocate savings to the investments with the highest yields, resources are tied up in less efficient uses, as households continue to reinvest their savings in their own businesses or those personally known to them. The growth of real output is constrained below its potential, since the capital stock is not as productive as it could be. The opportunity cost to the economy of self-financed investment is the loss of output which could have been produced with the more productive capital.

Under these circumstances, financial intermediaries can perform an important economic function by utilizing resources more efficiently. Gurley and Shaw (1955, 1956, 1960) presented a comprehensive analysis of how financial intermediaries facilitate investment finance. The intermediary acquires the liabilities of excess-spending units, and issues savers its own liabilities, which can be designed to provide the features attractive to households.[7] By converting their savings to financial assets, private savers release their resources to investors with more productive uses for them. Financial intermediaries have the knowledge and resources to locate those investment opportunities which yield the highest rate of return. Since intermediaries pool the savings of many individual savers, they maintain a larger, more diversified portfolio of assets, and are better equipped to invest in relatively risky enterprises.

Shaw (1973) and Coats and Khatkhate (1979) have examined how financial intermediation takes place in developing economies. Due to the limited size of financial institutions in these economies, the banking system provides the most widely held financial asset. Real money balances play a comparatively more important role in these economies than in developed economies with wide and diver-

7 Cheng (1980) has shown the importance of a real rate of return to savers for the growth of financial intermediation.

sified financial markets.[8] The expansion of the monetary sector represents a deepening of financial intermediation. The importance of this process is enhanced by the segmentation of investment opportunities in the developing economies, where the marginal efficiency of capital varies widely across sections. The activity of the banking sector works toward the unification of the disparate sectors, by channeling savings to the most profitable areas. The spread in returns across the economy, and the positive consequences for output of savings reallocation, have been analyzed by Galbis (1977).

The effect of money upon output in this literature, then, is due to its status as the principal financial asset in the developing economies. Since financial markets and other institutions are not present or exist on a small scale, banks play a vital intermediary role between household savers and investing units. The use of real money balances allows resources to be utilized in the financing of more efficient investments, and the construction of a more productive capital stock.

V. Money's Role in Production

The theoretical and empirical contributions which have been examined generally agree that the level of real output is influenced by the monetary sector. However, there exists disagreement over the nature of this relationship. In this section, the use of real money balances as an independent variable in production functions is evaluated from the viewpoint of development economics. This is followed by a summary of more recent studies of the production process, which attribute an indirect role to money via its effect on resource augmentation.

I. Money as a Productive Factor

The estimation of production functions which include real money balances assumes a specific type of relationship betwen money and the other independent variables, which arises from price theoretic foundations of production functions. These functions express the causal relationship between productive factors

8 McKinnon (1973) also deals with the role of money in investment finance in developing economies, but emphasizes a different mechanism. See Section III. 3.

and the measured output of goods. The inputs can be used in different combinations, as they are substitutes for each other.

The use of monetary assets to replace physical goods in production or labor in transactions for final goods is the usual focus of arguments for including money in production functions. The replacement of capital or labor by money in other activities allows these factors to be concentrated in the production of goods. The effective capital stock and labor force are thereby increased, due to the expansion of the monetary sector.

However, the study of economic development suggests a more complex matrix of relationships between money, productive resources and real output. The analysis of the formation of capital, summarized in Section III, stresses the role of the monetary sector in increasing the availability of capital through the level of savings and investment, rather than serving as a substitute good. A monetary variable may be appropriate for a savings function, or in some models, an investment function, and therefore part of a structural model of production. But this contribution of money to aggregate supply, resulting as it does from a larger capital stock, is already fully captured and reflected in the size of the capital stock itself, and therefore does not justify the inclusion of money as a direct input in the estimation of production functions.

The impact of financial intermediaries, as discussed in Section IV, also has quite different implications for the interpretation of money's role in production. The increased use of real money balances raises the quality of the capital stock through more efficient resource allocation. As more productive capital goods are produced, capital's overall productivity and real output will rise. While production functions assume homogeneous factors within the input categories, the analysis of money and savings allocation focuses specifically on the heterogeneous nature of capital, and the importance of discriminating between investments in allocating savings. Improved efficiency in this regard and the increase in output that results from the same quantity of capital resembles the outward shift in the production possibilities frontier that results from technical progess. Failure to reflect this role of real balances, by directly including them in the production function, would distort the nature of money's contribution to growth.

Moreover, money serves as a complement to real resources, rather than as a substitute. Since money is the medium of exchange, increased output and the use of capital or labor will be accompanied by larger money balances. The linkage, in this case, runs from factor demand to money. This form of complementary relationship was brought out by Davidson (1979):

> If anything, money is complementary to both labor and capital services; in other words, if entrepreneurs want, ceteris paribus, to increase the use of either capital or labor services during the interval covered by the prevailing contractual agreements, they must demand additional money to meet these additional contractual obligations.[9]

Finally, it has also been suggested that there exist discontinuities in the productive service of money, i.e., once an economy reaches a certain level of development, the productive role of money disappears. A production function, however, often assumes a declining but positive marginal physical product for all the inputs. Estimation of the production function assigns a positive role to money when this may no longer be a valid assumption.

Production functions which include money, therefore, can give improper and misleading impressions regarding the interrelationship of money and output in developing economies, although they do correctly indicate money's positive contribution. The estimated coefficient does not have the same economic significance as the parameters of labor and capital. Money may serve as a substitute to the inputs in some instances, but more importantly, it affects the availability and utilization of real resources. While the use of money does exert an impact upon aggregate supply, alernative models may more accurately express the nature of the process.

2. *Resource Augmentation*

A number of extensions of the research on money and production functions have appeared, which are theoretically more appealing. This work stresses that money affects aggregate supply indirectly through its resource-augmenting abilities.

Claasen (1975) accepted the proposal that the use of money allowed labor to be transferred from barter exchange to produc-

9 Davidson (1979), p. 281.

tion, but expressed this relationship in a different manner than Levhari and Patinkin (1968). An economy's production level is dependent upon its available capital stock and total labor services. The latter is divided between production and trading activities. If an increase in money allows more labor to be used in production, then:

$$N^P = N^P(m) \qquad N^P_m \geq 0 \tag{2}$$

where

N^P = labor used in production
m = real money balances

and the "marginal product" of money is actually the product of two partial derivatives,

$$\frac{dy}{dm} = \frac{\partial y}{\partial N^P} \frac{\partial N^P}{\partial m} \tag{3}$$

y = real output

Kapur (1975) constructed a neoclassical growth model specifically adapted for developing economies. First, he assumed the existence of a labor surplus so that entrepreneurs could obtain any amount of labor at a given real wage rate. The steady-state growth rate, therefore, becomes an endogenous variable, whereas it is an exogenous factor in most growth models. Second, Kapur accepted the suggestion that the use of money frees labor from search activities, and capital from use in inventories. He used these ideas to introduce real money balances into a model of production by including them as determinants of the fraction of resources devoted to final output. The production function in Kapur's model took the general form:

$$y = F[B[(m \cdot k)] \cdot K,\ A[(m \cdot L)] \cdot L] \tag{4}$$

$$B' > 0,\ B'' < 0,\ A' > 0,\ A'' < 0$$

where

K = capital
L = labor
A, B = fractions of K,L devoted to productive activity.

Kapur then used his model to demonstrate that an increase in nominal monetary expansion will raise the capital/labor ratio, which reduces the efficiency with which the scarce resource, capital, is used. As a result. the output/capital ratio and steady-state growth rate fall. A reduction in inflation can simultaneously

increase the economy's growth rate as well as the level of employment for any given capital stock. Policy makers do not face a choice between full employment and capital-intensive growth, as some analysts have asserted.

A similar approach has been taken by Subrahmanyam and Cosimano (1979), who also assume that money affects production through a factor-augmenting role. Their production function takes the form:

$$y = f[\alpha(m, T)\ L(T),\ B(m, T)K(T)] \qquad (5)$$

where

αL = labor employed in efficiency units
βK = capital employed in efficiency units
T = time.

Money is an index of endogenous technical changes, i.e., changes in the effective levels of the inputs, and time is a proxy for exogenous technical change.

The authors use this model to test for the direction of bias in technological change, and the elasticity of substitution. To do so, they asume cost-minimization and transform the model accordingly. The estimating equation is tested with data from the Indian economy over the 1950/51 through 1969/70 period. The results indicate that while the overall measure of bias has been capital-saving, the use of money has been labor-saving in nature. This indicates that the substitution of money for labor was more important than its role in capital formation.

While this conclusion is plausible in view of the history of monetary policy in India, Subrahmanyam and Cosimano's results must be treated with caution. The assumption of cost-minimization in this and a similar paper by Subrahmanyam (1980) implies that the real return to each factor is equated with its marginal physical product. This neoclassical result depends upon the existence of integrated, competitive factor markets. But factor markets in developing economies, like the capital markets described in Section IV, are characterized by barriers to mobility and imperfect knowledge of alternative opportunities. The exercise of monopoly power in these highly stratified markets leads to a gap between factor rewards and their marginal return. The abundance of labor, in particular, produces very low wage rates.

However, Subrahmanyam and Cosimano's work represents an

advance in this field. For the first time, an empirical model of production that treats money not as a separate variable, but as a determinant of the effective level of the real inputs, has been presented. Also, data drawn from a developing economy has been used to test the influence of money upon production.

These papers clarify the role of money in the determination of aggregate supply. While the original work in this field correctly drew attention to the importance of the monetary sector, its explication of the role of money was misleading. The use of money in its factor-augmenting capacity more clearly indicates the nature of the relationship between money and the real productive resources.

VI. Government Policies and Growth

The preceding sections have presented alternative views of the relationship of money and the output of goods. The common thread that runs through these models is the positive effect of real money balances in the determination of aggregate supply. This section examines government policies designed to foster growth through expansion of the monetary sector.

Tobin's original research on money and growth, summarized in Section II, provided a sophisticated defense of inflationary monetary policies. Since money balances were seen as a substitute for physical capital, their growth in real terms hindered development. Inflation decreases the demand for real balances by lowering the yield on money, and thus increases the capital/labor ratio and output. The impact of stimulative monetary policies upon long-run growth reinforced the appeal of expansionary policies already justified by the short-run Keynesian analysis.[10]

However, policies which recommended rapid nominal monetary growth neglected the productive role of money, as well as the gap between the simplified world of the neoclassical growth models and the actual conditions of the developing economies. These models deal with the expansion of production possibilities frontiers, while developing economies face immense difficulties in

10 For a summary of writings which advocate inflationary policies, see Thirlwall (1974, 1976).

reaching existing frontiers. Recognition of these omissions and discrepancies lead to the advocacy of alternative policies to encourage growth. One set of financial policies was advanced which encouraged the accumulation of capital through an expansion in real money balances. These policies, based on the works of Gurley and Shaw (1955, 1956, 1960), Patrick (1966), McKinnon (1973), Shaw (1973) and others, can be grouped together (despite differences among them) under the name "financial liberalization" or "financial deepening".

An increase in real money balances can be engineered through actions which stimulate the demand for money holdings, while adjusting the supply of nominal money in line with this demand. The demand for money balances is a positive function of their real rate of return and income.[11] Bank deposits or other financial assets should yield a rate of return that make them an attractive alternative to self or direct investment. The monetary authorities can ensure a positive return directly through their interest rate policy, a common tool of monetary management in developing economies. Tax policies, which exempt part or all of the interest payments on deposits, also raise their effective yield.

An objection to the use of interest rates to encourage money demand may be raised, on the grounds that this policy hinders growth by raising the cost of capital. This outcome is unlikely to be a significant problem when insufficient investment financing has hindered capital formation. If investment demand has gone unsatisfied because of financial repression, the increase in savings brought about by the higher interest rate closes the investment-savings gap, and allows more capital goods to be produced. Khatkhate (1980a and 1980b) has dealt with the import of interest rates on capital use.

The return on financial assets will be indirectly raised by monetary policies which dampen inflation. A stable price level is a more difficult goal to achieve in developing economies, partly because of internal structural rigidities and partly because of external price shocks. Allowing relative prices to adjust will dampen the inflationary impact of changes in the prices of foreign goods. The process of adjustment may entail short-run changes in real output as resources are reallocated among sectors; direct income assistance to displaced workers can be used to moderate the impact

11 This abstracts from the issue of inflation expectations.

of fluctuations in employment during the transition period, and is preferable to policy actions which impair trade.

The government can affect the demand for real money balances by increasing their attractiveness in other ways. Licensing practices and bank regulation establish the safety of bank deposits. Government-administered deposit insurance plans can guarantee this safety in the event of a bank collapse. Such actions increase the convenience and usefulness of money as an asset, thereby stimulating the demand for monetary assets.

Central banks can also actively aid the development of the private financial sector.[12] In developed countries, the government monetary authority usually was created after the banking system was well established. The private sector was still in an embryo stage, however, when central banks were instituted in the developing nations. Therefore, the central authority can guide and encourage the growth of those institutions judged most suitable for the economy and its stage of development.[13]

This task can be accomplished in numerous ways, including the exercise of traditional central banking functions, such as reserve policy. Banking regulations should be flexible enough to allow for growth, while forestalling the introduction of financial instruments currently inappropriate, but which may be acceptable at a later period. Central banks can directly provide technical assistance, in the form of seminars, training courses, and advisors to commercial banks.

VII. Summary

The subject matter of this paper encompasses a broad area of economic research. The unifying theme of the different strands of analysis is the positive role of money in the determination of aggregate supply. The links between money and output are many

12 See Bhatt (1974) and Bhatt and Meerman (1978).

13 The importance of this activity has not always been recognized. Bhatt and Meerman (1978) point out, "It is somewhat strange that, at an international level also, the promotional function of a central bank is not sufficiently stressed in providing technical and financial assistance to the LDCs for the purpose and evaluation of a sound financial structure. The result is that a large number of central banks have not been appropriately oriented toward development objectives in general and to the development of sound financial systems in particular."

and varied, and the different models summarized in the paper explore and illustrate the nature of the relationships.

The developing economies offer the best setting in which to examine the impact of expansion of the monetary sector upon real resources and output. The increase in savings that accompanies a rise in holdings of real balances represents additional resources released from the production of consumption goods and hence available for the production of capital. Foreign capital flows will respond to incentives designed to encourage the holding of money balances, and draw additional resources into the economy. If a significant amount of investment is self-financed, then a reduction in the cost of holding money may raise the level of such investment spending.

The utilization of money as a financial asset also affects the allocation of existing capital resources, and quality of new capital. The conversion of savings to monetary form frees up resources previously used in less efficient investments. The growth of the banking sector expands the possibilities of savings allocation; the choice of the investment program with the highest yield ultimately raises the productivity of the economy's capital stock.

Development theory, therefore, has emphasized the role of money in the formation and utilization of capital. Money exercises its productive role mainly through indirect channels. The relationship between money and aggregate supply has also been expressed through the use of money as a variable in production functions. The coefficients of these functions have been estimated with U.S. data, and money has been found to be a statistically significant determinant of output.

However, this attempt to directly express money's productive contribution may simplify too much. By suppressing the nature of the ties between money and capital, the production function suggests that money and capital can be considered independent factors of production. This masks the dynamics of what has been seen to be a complex and multi-faceted process, by which expansion of the monetary sector enlarges and improves the capital stock. A more sophisticated model of production incorporates money balances as a determinant of the effective level of the physical inputs. This class of model yields insights into the interrelationship of money, resources and output, and represents a promising field of further research.

Recognition of money's productive role has led to the advocacy of policies to expand the size of the monetary sector in real terms. These policies have emphasized the importance of positive real interest rates in establishing money as a competitive alternative to other assets, and of stable monetary policies in dampening inflation. Other government activities, such as bank regulatory procedures, can be geared toward upgrading and improving the financial structure of the developing countries. The experience of countries such as South Korea and Taiwan with such policies demonstrates that encouraging and facilitating the utilization of real money balances ultimately improve the allocation of resources and raises potential output.

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